DIMENSIONS NBS

The magazine of the
National Bureau
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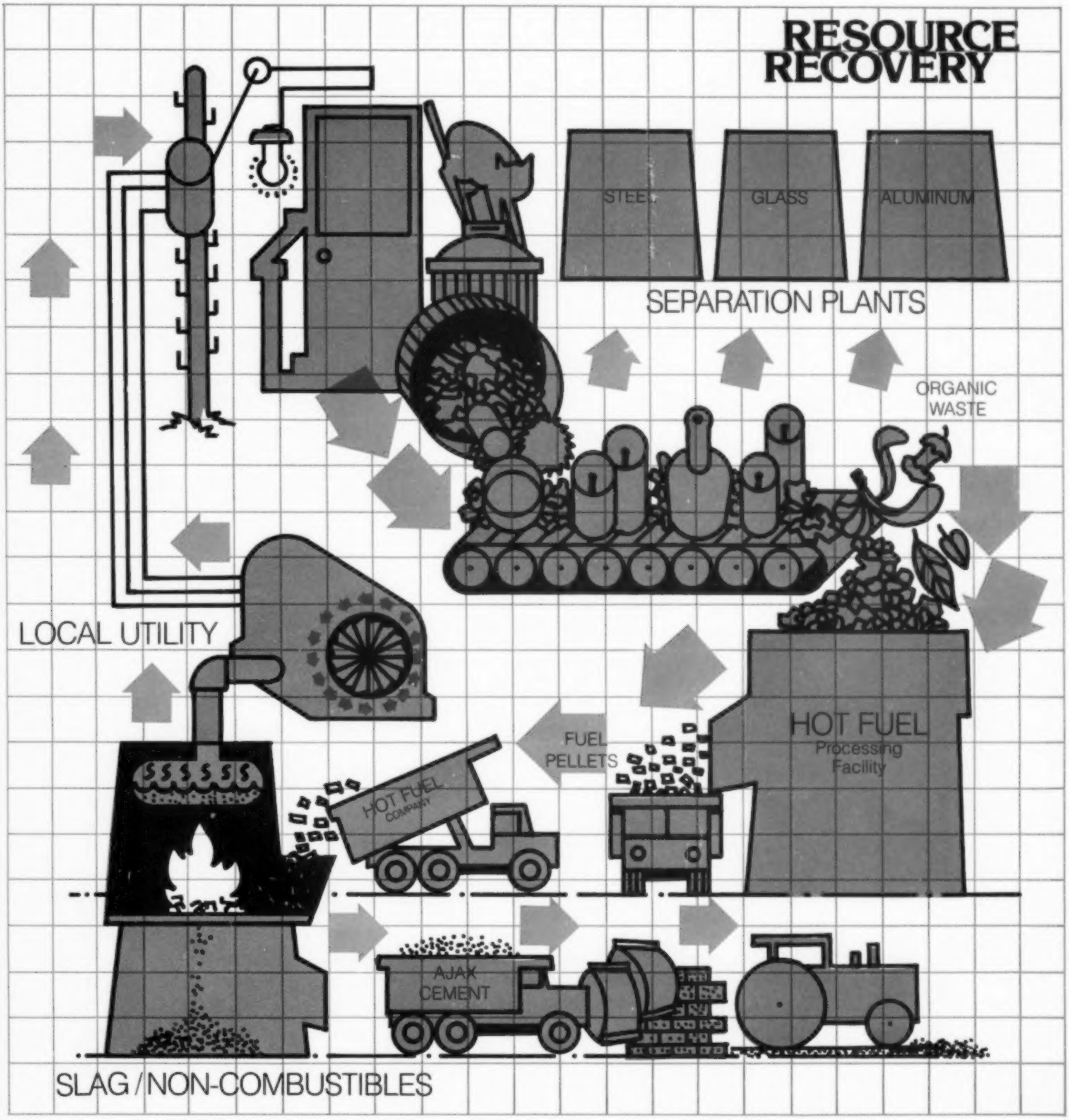
December 1979



ONCE IS NOT ENOUGH. See page 7.

COMMENT

MATERIALS RESEARCH FOR SYNFUELS

Although the general public is only now becoming aware of *Synfuels*, NBS involvement in the field has been long and extensive. Starting in 1971, divisions of the former Institute for Materials Research at NBS began working with the Office of Coal Research (Department of Interior) on materials programs important to the safe, efficient, and economical operation of coal conversion processes, such as coal gasification and liquefaction. The original materials research programs, although modified extensively both programmatically and organizationally, continue today under sponsorship of the Department of Energy through work being carried out in the NBS Center for Materials Science of the National Measurement Laboratory.

Throughout the years, our work has concentrated on gaining an understanding of degradative processes which limit the lifetimes of materials subjected to the harsh environments of coal conversion processes. We have focused our activities on the development of test methods and equipment needed to assess the behavior of materials in service. For instance, as described in this issue's Staff Reports, Center scientists have constructed a special apparatus which allows the determination of strength properties of refractories under the combined conditions of high temperatures and high pressures of steam and other gases found in coal gasification environments. A companion energy dispersive x-ray diffraction device permits *in situ* determination of the phase composition of the refractories under similar testing conditions, thus allowing a correlation of structure and mechanical properties to be made.

In other work within the program, we have developed ways to study the erosion of metals and ceramics at various temperatures as a function of particle velocity and impact angle. Further, we have investigated stress corrosion cracking using the constant strain rate method; perfected techniques to ascertain the vaporization characteristics of coal slag at high pressures and temperatures in reactive environments; and developed ways to measure coal slag viscosity under elevated steam pressures.

Center activities in *Synfuel* technology are not limited solely to experimental research. Currently, we are developing a comprehensive data center designed to provide up-to-date information on materials performance and properties to the synthetic fuel industry and researchers in the field. In the same vein, we regularly hold meetings on topical subjects such as the conferences on Materials for Coal Conversion and Utilization sponsored by the Department of Energy (DOE), Gas Research Institute (GRI), Electric Power Research Institute (EPRI), and NBS. October 1979 marked the third consecutive year NBS hosted this meeting which brought together over 250 materials scientists and engineers concerned with *Synfuels*.

Materials problems will continue to be a pervading issue in the eventual commercialization of coal conversion processes. It is expected that the Center for Materials Science will in the future, as it has done in the past, play a significant role in the development of materials test methods, standards, and critical data needed for *Synfuel* development.

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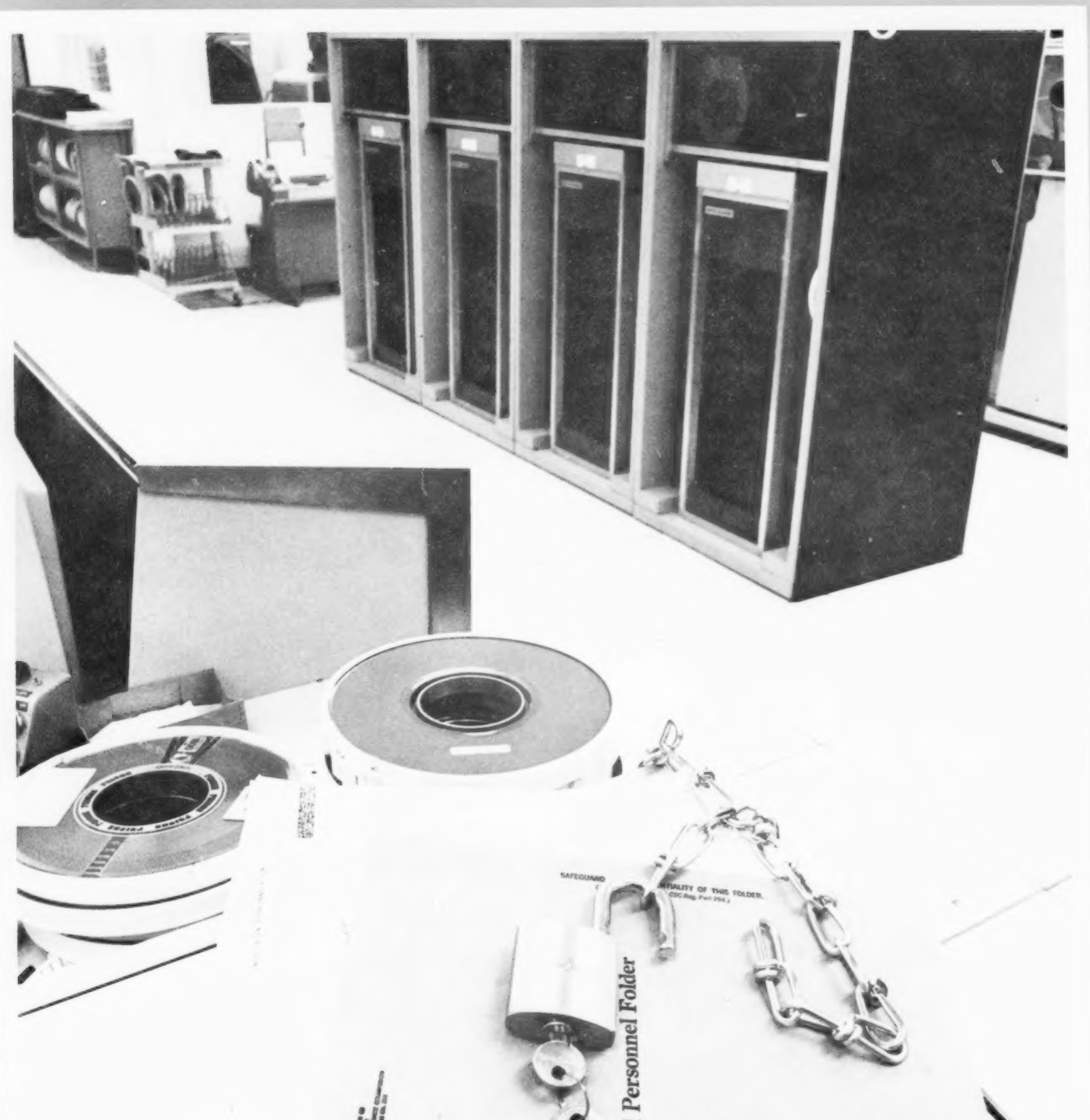
Contents

PROTECTING CITIZENS' RIGHTS



THE IMPACT OF COMPUTERS ON PERSONNEL ADMINISTRATION

by Shirley Radack

THE Office of Personnel Management no longer asks job applicants for personal information about political beliefs, arrests without convictions, or physical health.

- As a result of the Privacy Act of 1974, the U.S. Air Force no longer gives the home address of an employee to collection agency people nor gives out an employee's home phone number without the individual's permission.
- In 1968, the Bank of America began giving employees an opportunity to see their personnel records and more recently strengthened rules restricting the release of personal data from employment records to outside sources.

These are indicators of a changing trend over the past decade to extend privacy rights to employees.

These trends, along with assessment of the uses of personal data in employment recordkeeping, analyses of the impact of computers on personnel administration, and recommended policy actions to protect citizen rights are presented in a major study of computer use and privacy issues. Published as *Computers, Personnel Administration, and Citizen Rights* (NBS Special Publication 500-50)*, the study was conducted for the National Bureau of Standards' Institute for Computer Sciences and Technology (ICST) and the Privacy Protection Study Commission by Dr. Alan F. Westin, professor of public law and government at Columbia University.

The report is an outgrowth of a workshop on privacy held in 1973 under the auspices of ICST and the Association for Computing Machinery. The workshop attendees decided that it would be valuable to study areas of organizational recordkeeping that affected large numbers of people and that involved extensive computer use. Consequently, ICST contracted with Westin, an internationally recognized expert on privacy and individual rights, to lead a small interdisciplinary team of researchers to investigate several issues.

Westin's report of the earlier NBS study of privacy issues in health recordkeeping which resulted from this meeting has already been published (*Computer, Health Records, and Citizen Rights,*** NBS Monograph 157, December 1976). Twelve principles of fair information practices were presented (DIMENSIONS/NBS, May 1977).

In the current study of employment records, the team used a multi-faceted research methodology similar to that used in the health records project. They analyzed literature and reports on privacy in employment. Organizational managers, personnel specialists, computer software and systems developers, public interest and civil liberties groups, regulatory agency officials, and labor union representatives were interviewed. Furthermore, detailed on-site examinations of the U.S. Civil Service Commission (now Office of Personnel Management), the U.S. Air Force, and the Bank of America were conducted, focusing on organizational policies and computer use in the personnel area. Surveys were taken of workers' attitudes on employment privacy issues (see box on p. 4).

Privacy Issues Today

The years when this study was conducted (1975-1977) were a period of "quite rapid legal and policy change," according to the report. Instrumental in that change were: the Federal Privacy Act of 1974 which extended fair information practices to Federal civilian workers and members of the armed forces; State laws similar to the Federal Privacy Act; State and Federal laws that affected employer data practices; and court decisions dealing with privacy and access rights by employees.

As a result, many employers have revised their policies on personnel recordkeeping in both com-

DEFINING THE ISSUE

PRIVACY—the question of what personal information is relevant and proper for an organization to collect or store.

CONFIDENTIALITY — the question of how information about individuals should be distributed within the organization and when it should be released to outsiders.

INDIVIDUAL ACCESS—the question of whether individuals should be able to learn what information about them is being maintained in the data system, and have the opportunity to inspect, correct, or contest such data.

Radack is in the Office of the Director, NBS Institute for Computer Sciences and Technology.

** Available from Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The stock number is 003-003-02087-7; cost, $8.00.*

*** Available from Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The stock number is 003-003-01681-1; cost, $4.55.*

RESULTS OF WESTIN'S NATIONAL SURVEY OF INDIVIDUAL ATTITUDES CONCERNING PRIVACY RIGHTS IN EMPLOYMENT

- Half of the workers and executives surveyed consider their personnel records kept by employers to be "very important" in terms of privacy, and almost 60 percent regard a general right to see their personnel records as "very important."
- Almost a third said they did not know whether or not they could see their personnel records or performance appraisals.
- Almost a quarter of those interviewed feel their employers' current policies on confidentiality or employee access are poor or could be improved; over a third feel their employers do not generally hire, promote, or fire people "in a fair way."
- By overwhelming majority, the respondents favor enacting laws to give employees a right of access to their personnel records and to written "promotability" ratings, and a right to notification before their personal information is given up in answer to subpoenas.
- Majorities favor passage of laws to forbid employers to: require polygraph tests for job applications, inquire about arrest records that have not led to convictions, and inquire about a job applicant's homosexuality.
- Almost half of the respondents are more worried about the confidentiality of employee records when they are computerized.
- Though they favor the recognition of employee privacy rights, almost two-thirds are opposed to establishing a government supervisory agency to enforce such privacy rights against their employers.

puterized and manual systems. "They have decreased the scope of the information that they collect about employees; they have observed more extensive rules of internal confidentiality and data release to outsiders; some employees in many firms have been given a right of access to at least some of their personnel records where no such rights had been recognized previously. Additionally, there has been a strengthening of data security policies for both manual and automated files by many employers," says the report.

Despite these signs that a number of government and private employers are reviewing their policies on privacy of personnel data, Westin found that, except for Federal or State agencies under new privacy acts, only a small minority of employers in the country have actually installed comprehensive policies governing privacy, confidentiality, and employee access rights to their personnel files.

Trends in Computer Use and Personnel Administration

Employers' personnel record policies affect about 97 million people—the current U.S. labor force. As prospective employees, they fill out application forms containing information about their backgrounds, education, and prior employment. They often complete tests, interviews, and medical examinations, which become part of their employment records. Once on the job, data about their salaries, job titles, benefits, performance appraisals, promotions, discipline, training, awards, medical limitations, safety incidents, security investigations, and other personnel matters are added to their files.

This information is used by employers for personnel decisions as well as for many reporting requirements—paying taxes and Social Security, administering health and retirement benefits, and complying with government employee protection programs. Employment records are also sources of data sought by credit bureaus, banks, other employers, tax investigators, police, welfare agencies, insurance companies, researchers, and civil and criminal courts.

The use of computers for personnel recordkeeping began in the mid-1950's. According to the recent report, however, "automation of personnel functions has proceeded at a slower pace and has been less extensive or sophisticated than computer use in other sectors of organizational life."

From 1955 to 1965, the high costs of data storage, computing time, and conversion of data to machine-readable form limited most organizations' uses of computers to payroll and statistical reporting. However, technologic developments in the mid-1960's, such as random access to data files and on-line computer operations, extended computer use to development of employee profiles and skill inventories. By the 1970's, improved reliability of software and systems, the development of minicomputers, and advanced data communications made computer resources available to many organizations. During this period, government reporting requirements for Equal Employment Opportunity (EEO), Employee Retirement Income Security Act (ERISA),

PRINCIPLES IDENTIFIED BY WESTIN'S GROUP TO GUIDE ORGANIZATIONS THAT COLLECT AND USE PERSONNEL INFORMATION

- Decisions about an individual's rights, benefits, and opportunities in society should not be made by organizations on the basis of secret files, or record-based procedures about which individuals are not informed.
- Only information relevant to the organization's legitimate purposes should be collected and stored, and the definition of relevance must respect both guarantees of privacy and legislative prohibitions against making improper racial, sexual, cultural, and similar discriminatory decisions.
- Managers of a data system should take reasonable steps to insure that the records they keep are accurate, timely, and complete, as measured by the kinds of uses made of the data and the social impact of their use.
- Detailed rules of confidentiality should govern who within the organization maintaining the data system has access to a record, and this should be based on a need-to-know principle.
- Disclosure of personal data outside the organization that collected it should be made only with the informed and voluntary consent of the individual, obtained at the time of collection or by subsequent query, or under a constitutionally valid legal order.
- An individual should have a right to see his or her record, and have an effective procedure for contesting the accuracy, timeliness, and pertinency of the information in it. There may be some exceptions protecting confidential sources, but these should be rare.

and Occupational Safety and Health Act (OSHA) also increased.

According to Westin's report, "larger social trends" increased the importance of personnel activities. "These included the need for better identification and development of scarce management talents within the organization; labor-supply problems in particular job specialties, despite the labor-surplus setting of the overall period; and demands for greater work satisfaction and respect for individualism that increased in the social climate of the Seventies . . ."

As a result, sophisticated data base systems were developed to carry out payroll activities as well as to produce the required government reports and provide information for internal personnel management needs—education, training, performance evaluation, manpower planning, labor-management relations, and recruitment.

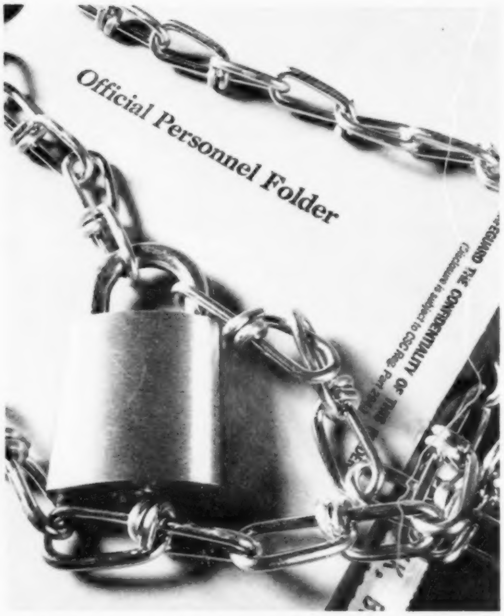
These systems, based on a central employee record that contains all the automated data about each person, "are now expanding through the business world, have begun to spread in government, and are appearing also in many large nonprofit organizations," states the report.

Assessing the Impact of Computers

To assess the effect of computer use on employee rights, the study team examined practices of the three large organizations mentioned earlier—the U.S. Civil Service Commission, the U.S. Air Force, and the Bank of America. In addition, the researchers surveyed computer use and privacy policies of five business firms, 37 State governments, local and county governments, and nonprofit groups, and others. Findings in four key areas were reported:

- *scope of data collection*—"automated files generally selected items from more extensive manual personnel files and were not therefore increasing the kinds or amounts of personal information collected about employees."
- *employee access*—"there has been a general trend toward giving employees a periodic printout of their automated record, primarily to insure accuracy and obtain updated information." However, management policy may exclude some items from employee review.
- *protecting the confidentiality of data within the organization*—computer systems "can accommodate whatever rules organizations have about sharing or compartmentalizing employee data within the organization." Accessibility to sensitive information can be controlled by defining access levels and by installing authorization codes and check procedures.
- *releasing employee data to third parties*—computers have had "less impact than the legal rules governing regulatory program reporting duties to government, public-record access under freedom of information laws, new organizational privacy policies, and similar factors."

In the 1970's, the issue of citizens' rights in the administration of records became a public policy issue. The impact of the Federal Privacy Act of 1974 (effective September 1975) on employee citizen rights was examined by Westin's team.



Westin's group concludes that societies with regard for individual rights should not allow machine and bureaucratic efficiencies to misshape organizational life along nondemocratic pathways. "Much is at stake for the quality of life in our electronic civilization."

They found, "The Privacy Act has expanded the right of employee access that existed prior to the Act, especially into the investigative-file area, but also into important phases of personnel administration, such as performance appraisals, and has opened the way for new avenues of administrative appeal or court action by employees who feel aggrieved by agency or commission actions.

"Federal employees seem to be skilled in using their access rights under the Privacy Act, and can now challenge any uses of personal information that violate moral or legal norms in American society. In terms of privacy rights, therefore, the situation of Federal employees is probably better than most other sectors of American employment."

In assessing the general impact of computers on personnel administration, the researchers found that "computerization has been of great help to employers, especially large employers, in administering complex tax and benefits programs for employees; meeting reporting requirements for government regulatory and employee-protection programs; coping with complicated wage, salary and benefits negotiations with unions; and doing studies of manpower needs, staffing problems, and similar future-oriented matters." However, no significant changes were identified in the way that individuals are being hired, supervised, promoted, disciplined, or discharged by their employers. ". . . important personnel decisions about individuals are being made just about as they were before EDP came to the personnel function. Where decisions are being made differently, it is in response to forces such as government employee protection programs, not automation."

Policy Recommendations

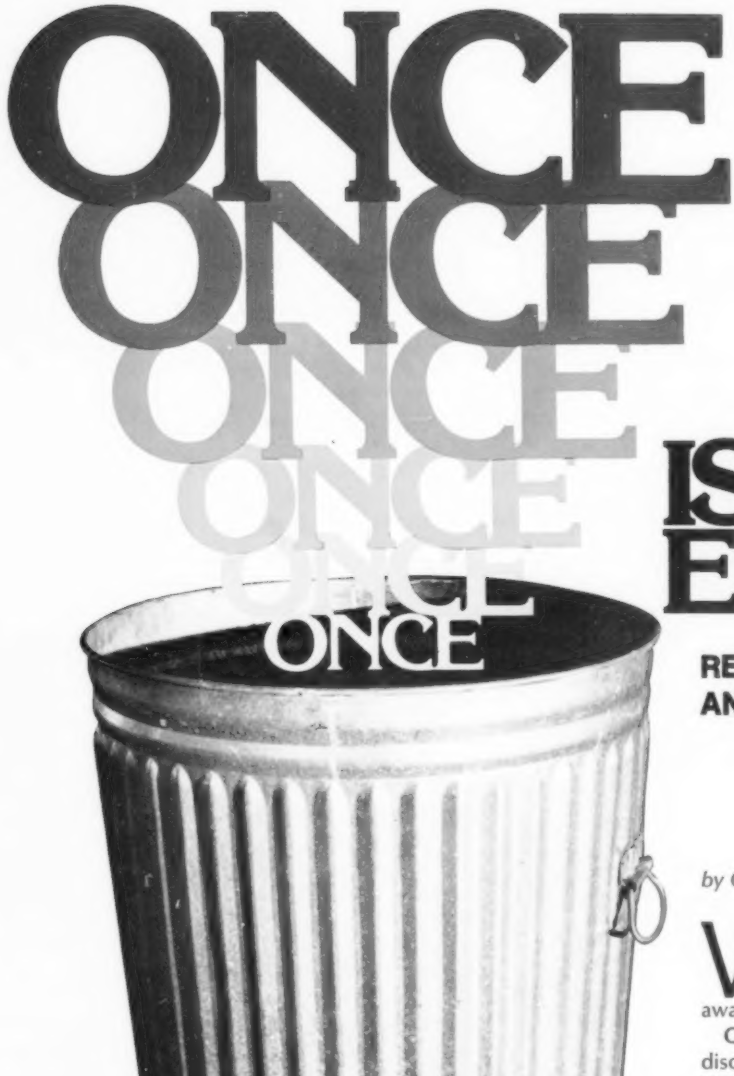
The study points out that although ". . . the personnel practices of many employers have changed profoundly during the past decade, it would be quite wrong to assume that all—or even most—employers now behave in exemplary fashion. . . . And even where employers have made the major changes in their hiring and personnel administration practices . . . there is still an important group of privacy issues remaining, about which employers and employees differ and on which American society will have to set lines of policy in the coming decade."

Therefore, Westin's team recommends that "measures do need to be taken to assure that citizen rights are effectively provided in the use of personal data in the employment process. While this is true for both manual and automated record systems, it is especially important where automated data systems contain substantial amounts of sensitive information that are capable of rapid access and extensive dissemination."

The report identifies six principles that have been widely accepted as goals for organizations that collect and use personnel information (see box on p. 5), and includes recommendations for "first-stage legislation" that will "facilitate evolutionary reforms in the data-handling aspects of personnel administration." As the focus of this legislation, the researchers suggest the State level since "States have traditional and primary jurisdiction over businesses and nonprofit firms operating within their borders."

Conclusion

The study group concludes that the implementation of sound principles and practices of fair information handling is essential, and that creating an awareness of the need for such practices is a "major task." "Pursuing such an objective is a major way in which societies with regard for individual rights can shape the future uses of computer technology by powerful organizations, rather than to allow machine and bureaucratic efficiencies to misshape organizational life along nondemocratic pathways. Much is at stake for the quality of life in our electronic civilization." □



ONCE IS NOT ENOUGH

RESOURCE CONSERVATION AND RECOVERY

by Gail Porter

WHEN you are finished reading this copy of DIMENSIONS/NBS what will you do with it? Chances are that you throw it away.

On the average, each person in the United States discards over a half ton of solid waste each year. The vast majority of this waste is buried in landfill areas.

It doesn't have to be this way. Many of the "waste" materials we toss away contain valuable materials—materials that can be recycled into new products with substantial energy savings compared to making the product from scratch, or materials that can be burned to recover some of the energy used to create them.

The members of Congress decided to do some-

Porter is a staff writer for DIMENSIONS/NBS.

thing about the approximately 160 million tons of municipal solid waste disposed of each year in the United States by voting the Resource Conservation and Recovery Act into law in 1976.

According to the text of the law, "... alternatives to existing methods of land disposal must be developed since many of the cities in the United States will be running out of suitable solid waste disposal sites within five years unless immediate action is taken."

The law specifically instructs the Secretary of Commerce to act, through the National Bureau of Standards, to develop guidelines for specifying the nature of products which have been recovered from wastes. These products include glass, steel, aluminum, and other metals removed from the total solid waste collection at separation plants, as well as organic refuse which has been processed into one of several forms of burnable fuel.

The Bureau is further directed to work with voluntary standards setting organizations to provide standards for these recovered materials in order to speed their introduction as items of trade. Often the established standards which stipulate acceptable levels of product quality include material specifications which exclude the use of recovered materials. The lack of appropriate standards for recovered materials thus hampers the sale and, ultimately, the recovery of these items.

"Our goal," says Joseph Berke, manager of the NBS Resource Conservation and Recovery Program, "is to try to develop guidelines for standards and test methods of items which are destined for disposal, thus increasing their marketability." Toward this end, Berke interacts with state and local governments who need technical assistance for recovery and conservation problems, with standards setting organizations such as the American Society for Testing and Materials (ASTM) and the American Society of Mechanical Engineers (ASME), and with other Federal agencies interested in resource recovery research.

Composition of Municipal Solid Waste*

*on a dry basis

Refuse-derived Fuels

One of the first priorities of the NBS research in this area, says Berke, is to provide information and standard methods of testing for refuse-derived fuels (RDF). The idea behind RDF is to use the organic, and thus burnable, portion of municipal solid waste to produce heat which can be converted into steam for either the production of electricity or for other industrial applications.

Organic trash, which represents about 80 percent of all the garbage that is collected, is processed to produce a refined fuel from which most of the metal, glass, and heavier items have been removed. The fuels are processed into several shapes and forms which require less storage space, are easier to manage than raw refuse, and are more homogeneous in composition. Some of these forms include fluff (which looks like shredded paper), pellets, and powder. In these forms, organic trash can be used as a supplemental energy source for coal-burning power plants or as the primary fuel for specially designed incinerators.

However, several major hurdles need to be cleared before a significant number of homes will be lighted by garbage, so to speak.

Thermodynamic Data

There is a need for basic information about how refuse and refuse-derived fuels behave when burned.

Thermodynamic data on refuse, RDF, and the common ingredients of refuse are needed by incinerator designers and engineers to calculate the efficiency of incinerators, and the heat released by the combustion processes. Some of these data have not been readily available because the use of refuse-derived fuels is so new.

"Our job," says Eugene Domalski, research chemist in the NBS Chemical Thermodynamics Division, "is to collect the data in a usable form and then make it accessible to engineers and scientists who can use it."

A report designed to provide this kind of information was published by NBS in 1978 as part of a project sponsored by ASME. The report, entitled "Thermodynamic Data for Waste Incineration," * lists thermodynamic data for a total of 331 materials from animal carcasses to Navy beans, from castor oil to shrubbery.

Engineers also need to know the energy content of the waste material (refuse or RDF) they are going to burn in their incinerators before it is used. This type of measurement for traditional fuels such as gasoline or fuel oil can be made with an instrument called a combustion bomb calorimeter in which a tiny sample of fuel is burned and the heat given off is measured precisely. For such relatively homogeneous fuels, only a few grams (a dime weighs about 2.5 grams) are needed to adequately represent a much larger amount. However, the heterogeneous nature of refuse and RDF requires that much larger samples be used.

A calorimeter that can accommodate 25 grams of substance, ten times the capacity of instruments in current use, has been developed by Domalski's group with funding from the Environmental Protection Agency and the Department of Energy. During the next three years, with funding from DOE and the support of ASME and ASTM, they will be designing progressively larger models. Their goal is to produce a calorimeter that can accommodate burning samples weighing between 2.5 and 25 kilograms (5.5 and 55 pounds).

Other difficulties with the use of RDF arise from the complexity of materials funneled into solid waste disposal. Incineration of hundreds of different materials with different chemical formulas can create a highly corrosive substance—sort of a chemical "stew." The vapors of "juices" in this mixture put the durability of conventional metals used in incinerators to a real test. Chemicals released in the incinerating process such as sulphur, carbon dioxide, and carbon monoxide can eat away at exhaust piping systems and other interior surfaces at a rapid rate. Damage caused by corrosion can be extremely costly, since even a small incineration facility may cost as much as $9 million to build.

To help with this problem, researchers from the Bureau's Chemical Stability and Corrosion Division have begun an effort to characterize the environment inside a pilot refuse incinerator in Wayne County, Michigan. After subjecting test metal specimens to this environment, says project leader William Gerhold, they will be able to give incinerator designers and engineers an idea of what materials will provide the best corrosion resistance.

Fly Ash, Bottom Ash, Slags and Sludges

A related problem is what to do with wastes

"HE HEARD WE BURN IT TO GENERATE ELECTRICITY, AND WE USE IT FOR LANDFILL, SO HE WANTS TO SELL IT TO US."

* *NBSIR 78-1479 by Eugene S. Domalski, William H. Evans, and Thomas L. Lobe, Jr. Copies available for $8.00 from the National Technical Information Service, Springfield, VA 22151. Order by PB 284659.*

Right. Jennifer Colbert, a chemist with the NBS Chemical Thermodynamics Division, grinds some organic garbage to powder form.

created by the burning of the fuels. Any furnace-type process will leave behind unburnable components. In the case of coal-burning power plants, these materials take the form of very fine fly ash (so called because it is light enough to be carried by the air); heavier bottom ash; a still heavier molten/solid substance called boiler slag; and "scrubber sludges," semi-solid materials collected at power plants by air pollution control equipment. More than 60 million tons of these substances were produced by coal-burning power plants during 1978, according to the National Ash Association and Edison Electric Institute.

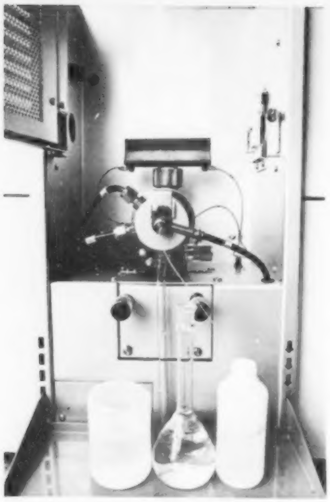
Despite their rather unappealing names, these materials can have a variety of uses. They may be useful as ingredients of cements and concrete; as material for subbases of roads; as structural fill on construction sites; as fillers in asphalt mixes; as roofing granules; as a form of ice control to replace sand and salt; as an extender in the manufacture of plastics; and even as a raw material for the production of aluminum.

In the past, getting rid of ash, slag, and sludge residues has been an expense for power companies who paid to have it hauled away. Now, says Carl Robbins, a research chemist in the NBS Ceramics, Glass and Solid State Science Division, "utilities are interested in selling this material." The problem is to produce specific materials that people are willing to buy. Because the residues of power plants are as variable as the coal and RDF which create them, the utilities need ways to establish the elemental composition and other characteristics of the wastes their plants produce and to have a system of quality control to aid in marketing the material as a product.

Over the next few years, Robbins plans a number of studies to answer some of these needs. Samples of these materials collected from power plants across the country will be thoroughly characterized. Neutron activation analysis, in which radioactivity is induced in a sample, will be used to simultaneously determine major and minor elemental constituents. Quantitative x-ray powder diffractometry, which involves bouncing x-rays off crystalline surfaces and measuring the angle of reflection, will help to identify the types of crystals in the materials. Scanning electron microscopy will be used to magnify surfaces so that the material's innermost structure can be examined.

In another part of the project, researchers will be collecting information on the operation and efficiency performance of individual furnaces. By comparing the variety of coal and RDF burning procedures used by power companies, Robbins hopes to be able to recommend methods that recover the maximum amount of energy from the fuel while producing the most usable types of "waste" materials.

While Robbins and his coworkers consider the chemical aspects of power plant residue and its production, several researchers of the NBS Center for Building Technology (CBT) are contributing to new test methods and standards that facilitate the use of



Left. Leachate from coal fly ash is analyzed for toxic metals with a technique called flame atomic absorption spectrometry. Bottom. Physical science technician Terry Rush records the concentration of each metal under test as the solution is aspirated into the flame.

fly ash, bottom ash, slag and sludge in construction materials. In particular, says Geoffrey Frohnsdorff, leader of the CBT building composition group, fly ashes and blast-furnace slags from iron production are good candidates for use in cement manufacture.

Although these materials can often "do the job" as well as other materials that require more energy to produce, the lack of data about them, the lack of standard methods of characterization, and the lack of provisions for their use in present standards has slowed their introduction into U.S. construction markets. As chairman of an ASTM subcommittee which develops standards for recycled materials used in construction, Frohnsdorff has been actively involved in this area for some time.

One ASTM standard was modified this year to broaden the range of amounts of fly ash that can be used in blended cements. Two additional ASTM standards are being developed that would specify the requirements for blast-furnace slags to be used in cements and concretes.

The whole idea of "performance based" standards for materials which specify user requirements such as strength and durability rather than physical dimensions or materials is strongly supported by the NBS Center for Building Technology, says Frohnsdorff. "If you have a good performance specification, it doesn't really matter what material you use."

Leaching Properties

But what happens to the millions of tons of power plant and other industrial residues that are being produced before economically feasible markets can be found for them? The vast majority are buried in landfills. If chemicals from the residues leach out into the soil surrounding them in sufficient quantities, they may eventually end up in streams and other sources of drinking water in dangerous amounts. EPA has proposed guidelines that specify the concentrations above which leaching of certain toxic elements such as arsenic, bar-

Right. Research chemist Barry Diamondstone adjusts a pH meter during a test of leaching properties of coal fly ash. The agitation device was developed at NBS to determine the reproducibility of a proposed EPA leach procedure.

ium, lead and mercury from landfilled areas would pose environmental and health hazards. The extraction method EPA is proposing for determining the leaching characteristics of waste materials is being applied by NBS to the evaluation of two existing NBS Standard Reference Materials*—SRM 1633 A Coal Fly Ash and SRM 1645 River Sediment. The purpose of this study is to determine the reproducibility of the EPA leach test on materials of proper homogeneity and whose chemical composition has been rigorously established.

"We're going to report what we are able to accomplish in a rather idealized sample" says Robert Burke of the atomic and molecular spectrometry research group," as a preliminary measure of the value of the EPA test method for analysis of actual waste materials." Ultimately, this group will provide EPA with standard test data which they feel best characterize the leaching properties of several solid wastes under study.

One final area of resource recovery in which the Bureau is involved is that of specifications and standards for metals recovered from wastes. Metallurgist James Early, an NBS pioneer in this type of research, has been working with an ASTM committee on resource recovery since 1975*. Although scrap steel has been routinely used by the iron and steel industry for many years, most of the scrap reused comes from known industrial sources or special scrap sources such as junked automobiles that are relatively easy to characterize. Steel scrap recovered from municipal wastes can vary in composition and usually includes a small percentage of organic material such as paper which is considered a contaminant. A standard method for determining this percentage in a given sample of recovered scrap has been evaluated by NBS and is now under review by ASTM for adoption as a standard. Once reliable test methods are agreed on, manufacturers will be able to buy recovered metals with confidence that the material meets certain quality specifications.

Among those involved in resource conservation and recovery research, there seems to be no doubt that improved standards and better methods for characterizing waste materials will improve the marketability of these materials so that they will be regarded as valuable resources rather than bothersome castoffs. And as the supply of all current forms of energy continues to tighten, recovering the energy of our so called "waste" materials may soon become as necessary as it is desirable. □

** SRM's are well characterized materials or measuring devices which have one or more physical or chemical properties certified by NBS. SRM's are widely used for calibrating or testing all kinds of measuring instruments.*

** Early is currently serving as Secretary of the ASTM Committee E38, Resource Recovery.*

SPECIAL

Guidelines for Use of the MODERNIZED METRIC SYSTEM

Actions at the 1979 General Conference on Weights and Measures (CGPM)*

Since the last publication of the NBS guidelines for the use of the International System of Units (SI) in 1977, three important actions concerning SI have been taken by the General Conference on Weights and Measures. This revised version of the NBS guidelines reflects these decisions.

At their meeting in Paris, France, October 8-12, 1979, the General Conference:

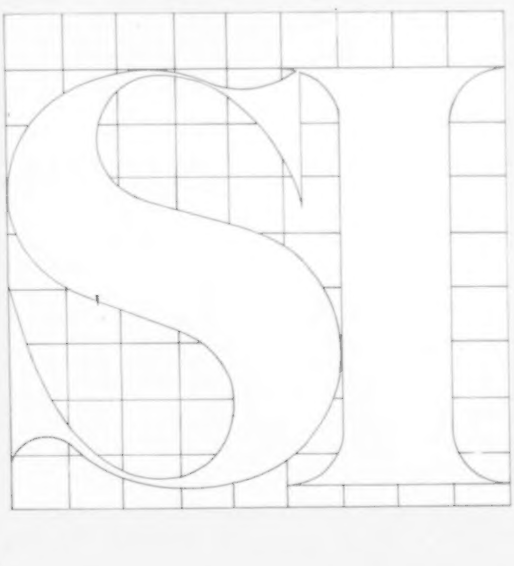
(1) Redefined the base SI unit candela to read—The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540 $\times 10^{12}$ hertz and of which the radiant intensity in that direction is 1/683 watt per steradian.

(2) Adopted the special name sievert, symbol Sv, for the SI unit of dose equivalent in the field of radiological protection. The sievert is equal to one joule per kilogram.

(3) Adopted l and L as alternative symbols for the unit liter.

Ernest Ambler
Director

** E. Ambler was the U.S. delegate to the CGPM, accompanied by advisors Francis X. Cunningham (Department of State), Edward L. Brady (NBS), and Abraham S. Friedman (American Embassy, Paris).*



The International System of Units

THE following Guidelines have been adopted by the National Bureau of Standards of the U.S. Department of Commerce for use of the International System of Units (SI),[1] informally called the metric system.

These Guidelines[2] reflect the decisions of the General Conference on Weights and Measures (CGPM) and its subordinate Committees which defined the modernized metric system and gave offi-

[1] The International System of Units (SI) was initially defined and given official status by the 11th General Conference on Weights and Measures, 1960. A complete listing of the SI units is presented in NBS Special Publication 330, 1977 Edition. A summary of the SI is given in Appendix 1 of this document.

[2] These Guidelines supersede LC 1056 dated November 1977 and those that appeared in DIMENSIONS/NBS, October 1977.

cial status to SI in 1960. The United States holds a place on these international bodies by virtue of its adherence to the Treaty of the Meter, signed in 1875. The National Bureau of Standards acts as the official U.S. representative to the various international bodies formed by the Treaty.

The National Bureau of Standards, in light of the Metric Conversion Act of 1975, recommends the use of metric units except in contexts where the exclusive use of metric units would needlessly confuse the intended audience. In these cases, the dual use of metric and inch-pound (customary) units may serve the two purposes of not only communicating the contents but also familiarizing the readers with the new metric system.

In all cases, NBS recommends a common-sense approach to metric conversion. These Guidelines are meant to provide NBS recommendations on the use of the modernized metric system while recognizing the evolving nature of metric practice in the U.S.

For further information concerning metric conversion in the United States, the reader should contact the U.S. Metric Board, 1815 N. Lynn Street, Suite 600, Arlington, VA 22209. For further information about the metric system, contact the NBS Office of Technical Publications, Washington, D.C. 20234.

The Metric System: SI

The SI is constructed from seven base units for independent quantities plus two supplementary units for plane angle and solid angle. (See table 1). Units for all other quantities are derived from these nine units. In table 2 are listed 19 SI derived units with special names. These units are derived from the base and supplementary units in a coherent manner, which means they are expressed as products and quotients of the nine base and supplementary units without numerical factors. All other SI derived units, such as those in tables 3 and 4, are similarly derived in a coherent manner from the 28 base, supplementary, and special-name SI units. For use with the SI units, there is a set of 16 prefixes (see table 5) to form multiples and submultiples of these units. For mass, the prefixes are to be applied to the gram instead of to the SI base unit, the kilogram.

The SI units together with the SI prefixes provide a logical and interconnected framework for measurements in science, industry, and commerce. NBS encourages the use of SI in the United States.

Fundamental Constants/Natural Units

In some cases, quantities are commonly expressed in terms of fundamental constants of nature, and use of these constants or "natural units" is acceptable. The author, however, should state clearly which natural units are being used; such broad terms as "atomic units" should be avoided when there is danger of confusion.

Typical examples of natural units are:

Unit	Symbol
elementary charge	e
electron mass	m_e
proton mass	m_p
Bohr radius	a_0
electron radius	r_e
Compton wavelength of electron	λ_C
Bohr magneton	μ_B
nuclear magneton	μ_N
speed of light	c
Planck constant	h

Units Acceptable for Use with SI

Certain units which are not part of the SI are used so widely that it is impractical to abandon them. The units that are accepted for continued use with the International System are listed in table 6. It is likewise necessary to recognize, outside the International System, the following units which are used in specialized fields:

Unit	Symbol
electron volt	eV
unified atomic mass unit	u
astronomical unit	AU
parsec	pc

The units shown with an asterisk in table 7 are used in limited fields and have been authorized by the International Committee for Weights and Measures (CIPM), the international committee that guides the technical work of the Treaty of the Meter, for temporary use in those fields.

The short names for compound units (such as "coulomb" for "ampere second" and "pascal" for "newton per square meter") exist for convenience, and either form is correct (see table 2). For example, communication sometimes is facilitated if the author expresses magnetic flux in the compound term volt seconds (instead of using the synonym, webers) because of the descriptive value implicit in the compound phrase.

Special Considerations

The kelvin (K) is the SI base unit of temperature; this unit is properly used for expressing temperature and temperature intervals. However, wide use is also made of the degree Celsius (°C) for expressing temperature and temperature intervals. The Celsius scale (formerly called centigrade) is related directly to thermodynamic temperature (kelvins) as follows:

The temperature interval one degree Celsius equals one kelvin exactly.

Celsius temperature (t) is related to thermodynamic temperature (T) by the equation:

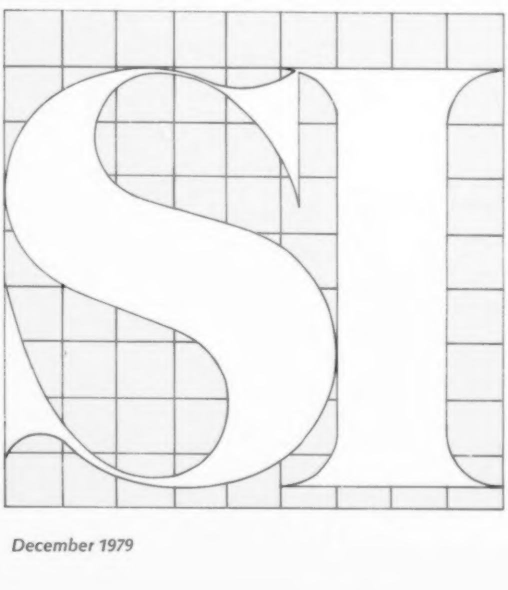
$$t = T - T_0$$

where $T_0 = 273.15$ K by definition.

Words and symbols should not be mixed. If mathematical operations are indicated, for example, only symbols should be used. Any of the forms "joules per mole," "J/mol," "J•mol^{-1}" is considered good usage, but the forms "joules/mole" and "joules•mol^{-1}" are not. See Appendix 2 for additional rules.

Logarithmic measures such as pH, dB (decibel), and Np (neper) are acceptable.

Over the years the term *weight* has been used to designate two quantities: *mass* and *force*. NBS supports the recommendation in the American National Standard for Metric Practice quoted in Appendix 3, that the term *weight* should be avoided in technical publications except under circumstances in which its meaning is completely clear.



It is also recommended that the terms *atomic weight* and *molecular weight* be replaced by *relative atomic mass* and *relative molecular mass* in accordance with established international practice.[3]

Descriptive and Essential Data

Descriptive data describe arrangements, environments, noncritical dimensions and shapes of apparatus, and similar measurements not affecting calculations or results. Such data should be expressed in SI units unless this makes the expression excessively complicated. For example, commercial gauge designations, commonly used items identified by nominal dimensions, or other commercial nomenclatures (such as drill sizes, or standards for weights and measures) expressed in inch-pound units are acceptable.

Essential data express or interpret the quantitative results being reported. All such data shall be expressed solely in SI units except in those fields where (a) the sole use of SI units would create a serious impediment to communications, or (b) SI units have not been specified. Exceptions may also occur when dealing with commercial devices, standards, or units having some legal definition, such as commercial weights and measures. Even in such instances, SI units should be used when practical and meaningful; for example, this may be done by adding non-SI units in parentheses after SI units. In tables, SI and inch-pound units may be shown in parallel columns. If coordinate markings in non-SI units are included in graphs, they should be displayed on the top and right-hand sides of the figure.

Additional References

For additional information on the use of SI units, the reader is directed to the following publications:

NBS SP 330, 1977 Edition, "The International System of Units: SI," the translation of the official text, "Le Système International d'Unités," (1977).

ISO International Standard 1000 (1973 Edition) "SI Units and Recommendations for Use of Their Multiples."

American National Standard Z210.1-1976, American Standard for Metric Practice.

Examples of conversion factors from non-SI units to SI are provided in table 7.

[3] *ISO 31/VIII "Quantities and Units of Physical Chemistry and Molecular Physics."*

APPENDIX 1
Units and Conversion Factors

TABLE 1. **SI base and supplementary units**

	Quantity*	Unit Name	Unit Symbol
SI base units	length	meter	m
	mass[1]	kilogram	kg
	time	second	s
	electric current	ampere	A
	thermodynamic temperature	kelvin	K
	amount of substance	mole	mol
	luminous intensity	candela	cd
SI supplementary units	plane angle	radian	rad
	solid angle	steradian	sr

[1] See Appendix 3 for a discussion of the terms "mass" and "weight."
* Quantity here and in Tables 2, 3, 4, and 7 means a measurable attribute.

TABLE 2. **SI derived units with special names**

Quantity	SI Unit			
	Name	Symbol	Expression in terms of other units	Expression in terms of SI base units
frequency	hertz	Hz		s^{-1}
force	newton	N		$m \cdot kg \cdot s^{-2}$
pressure, stress	pascal	Pa	N/m^2	$m^{-1} \cdot kg \cdot s^{-2}$
energy, work, quantity of heat	joule	J	$N \cdot m$	$m^2 \cdot kg \cdot s^{-2}$
power, radiant flux	watt	W	J/s	$m^2 \cdot kg \cdot s^{-3}$
quantity of electricity, electric charge	coulomb	C	$A \cdot s$	$s \cdot A$
electric potential, potential difference, electromotive force	volt	V	W/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-1}$
capacitance	farad	F	C/V	$m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$
electric resistance	ohm	Ω	V/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-2}$
conductance	siemens	S	A/V	$m^{-2} \cdot kg^{-1} \cdot s^3 \cdot A^2$
magnetic flux	weber	Wb	$V \cdot s$	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-1}$
magnetic flux density	tesla	T	Wb/m^2	$kg \cdot s^{-2} \cdot A^{-1}$
inductance	henry	H	Wb/A	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}$
Celsius temperature[a]	degree Celsius	°C		K
luminous flux	lumen	lm		$cd \cdot sr$[b]
illuminance	lux	lx	lm/m^2	$m^{-2} \cdot cd \cdot sr$[b]
activity (of a radionuclide)	becquerel	Bq		s^{-1}
absorbed dose, specific energy imparted, kerma, absorbed dose index	gray	Gy	J/kg	$m^2 \cdot s^{-2}$
dose equivalent, dose equivalent index	sievert	Sv	J/kg	$m^2 \cdot s^{-2}$

[a] See Special Considerations, p.15.
[b] In this expression the steradian (sr) is treated as a base unit.

TABLE 3. **Some SI derived units expressed in terms of base units**

Quantity	SI Unit	Unit Symbol
area	square meter	m^2
volume	cubic meter	m^3
speed, velocity	meter per second	m/s
acceleration	meter per second squared	m/s^2
wave number	1 per meter	m^{-1}
density, mass density	kilogram per cubic meter	kg/m^3
current density	ampere per square meter	A/m^2
magnetic field strength	ampere per meter	A/m
concentration (of amount of substance)	mole per cubic meter	mol/m^3
specific volume	cubic meter per kilogram	m^3/kg
luminance	candela per square meter	cd/m^2

TABLE 4. **Some SI derived units expressed by means of special names**

	SI Unit		
Quantity	**Name**	**Symbol**	**Expression in terms of SI base units**
dynamic viscosity	pascal second	Pa·s	$m^{-1}\cdot kg\cdot s^{-1}$
moment of force	newton meter	N·m	$m^2\cdot kg\cdot s^{-2}$
surface tension	newton per meter	N/m	$kg\cdot s^{-2}$
power density, heat flux density, irradiance	watt per square meter	W/m^2	$kg\cdot s^{-3}$
heat capacity, entropy	joule per kelvin	J/K	$m^2\cdot kg\cdot s^{-2}\cdot K^{-1}$
specific heat capacity, specific entropy	joule per kilogram kelvin	J/(kg·K)	$m^2\cdot s^{-2}\cdot K^{-1}$
specific energy	joule per kilogram	J/kg	$m^2\cdot s^{-2}$
thermal conductivity	watt per meter kelvin	W/(m·K)	$m\cdot kg\cdot s^{-3}\cdot K^{-1}$
energy density	joule per cubic meter	J/m^3	$m^{-1}\cdot kg\cdot s^{-2}$
electric field strength	volt per meter	V/m	$m\cdot kg\cdot s^{-3}\cdot A^{-1}$
electric charge density	coulomb per cubic meter	C/m^3	$m^{-3}\cdot s\cdot A$
electric flux density	coulomb per square meter	C/m^2	$m^{-2}\cdot s\cdot A$
permittivity	farad per meter	F/m	$m^{-3}\cdot kg^{-1}\cdot s^4\cdot A^2$
permeability	henry per meter	H/m	$m\cdot kg\cdot s^{-2}\cdot A^{-2}$
molar energy	joule per mole	J/mol	$m^2\cdot kg\cdot s^{-2}\cdot mol^{-1}$
molar entropy, molar heat capacity	joule per mole kelvin	J/(mol·K)	$m^2\cdot kg\cdot s^{-2}\cdot K^{-1}\cdot mol^{-1}$
exposure (x and γ rays)	coulomb per kilogram	C/kg	$kg^{-1}\cdot s\cdot A$
absorbed dose rate	gray per second	Gy/s	$m^2\cdot s^{-3}$

TABLE 5. **SI prefixes**

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^{18}	exa	E	10^{-1}	deci	d
10^{15}	peta	P	10^{-2}	centi	c
10^{12}	tera	T	10^{-3}	milli	m
10^{9}	giga	G	10^{-6}	micro	μ
10^{6}	mega	M	10^{-9}	nano	n
10^{3}	kilo	k	10^{-12}	pico	p
10^{2}	hecto	h	10^{-15}	femto	f
10^{1}	deka	da	10^{-18}	atto	a

TABLE 6. **Units in use with the International System**

Name	Symbol	Value in SI Unit
minute	min	1 min = 60 s
hour	h	1 h = 60 min = 3 600 s
day	d	1 d = 24 h = 86 400 s
degree	°	1° = $(\pi/180)$ rad
minute	′	1′ = $(1/60)° = (\pi/10\ 800)$ rad
second	″	1″ = $(1/60)′ = (\pi/648\ 000)$ rad
liter	L*	1 L = 1 $dm^3 = 10^{-3}\ m^3$
metric ton	t	1 t = 10^3 kg
hectare	ha	1 ha = $10^4\ m^2$

* An alternative symbol for liter is "l". Since "l" can be easily confused with the numeral "1," the symbol "L" is recommended for United States use.

TABLE 7. **Examples of conversion factors from non-SI units to SI**

Quantity	Name of Unit	Symbol for Unit	Definition in SI Units
length	inch	in	2.54×10^{-2} m
length	nautical mile*	nmi	1852 m
length	angstrom	Å	10^{-10} m
velocity	knot*	kn	(1852/3600) m/s
cross section	barn*	b	$10^{-28}\ m^2$
acceleration	gal	Gal	$10^{-2}\ m/s^2$
mass	pound (avoirdupois)	lb	0.453 592 37 kg
force	kilogram-force	kgf	9.806 65 N
pressure	millimeter of mercury at 0°C	mmHg	133.322 Pa†
pressure	atmosphere	atm	101 325 Pa
pressure	torr	Torr	(101 325/760) Pa
pressure	bar*	bar	10^5 Pa
stress	pound-force per sq in	lbf/in^2	6 894.757 Pa†
energy	British thermal unit (Int. Table)	Btu	1055.056 J†
energy	kilowatt hour	kWh	3.6×10^6 J
energy	calorie (thermochemical)	cal	4.184 J
activity (of a radionuclide)	curie*	Ci	3.7×10^{10} Bq
exposure (x or γ rays)	roentgen*	R	$2.58 \times 10^{-4}\ C{\cdot}kg^{-1}$
absorbed dose	rad*	rd	1×10^{-2} Gy
dose equivalent	rem*	rem	1×10^{-2} Sv

* The CIPM has sanctioned the temporary use of these units.
† Approximate; all other conversion factors are exact.

APPENDIX 2

Writing Style Guides

1. CAPITALS

Units: When written in full, the names of all units start with a lowercase letter, except at the beginning of a sentence or in capitalized material such as a title. Note that in degree Celsius the unit "degree" is lowercase but the modifier "Celsius" is capitalized. The "degree centigrade" is obsolete.

Symbols: Unit symbols are written with lowercase letters except that (1) the first letter is uppercase when the name of the unit is derived from the name of a person and (2) the symbol for liter is capital L.

Prefixes: The symbols for numerical prefixes for exa(E), peta(P), tera(T), giga(G), and mega(M) are written with uppercase letters, all others with lowercase letters. All prefixes are written in lowercase letters when written out in full, except where the entire unit name is written in uppercase letters.

2. PLURALS

a. When written in full, the names of units are made plural when appropriate. Fractions both common and decimal are always singular.

b. Symbols for units are the same in singular and plural (no "s" is ever added to indicate a plural).

3. PERIODS

A period is NOT used after a symbol, except at the end of a sentence.

4. THE DECIMAL MARKER

The dot (point) is used as the decimal marker and is placed on the line. In numbers less than one, a zero must be written before the decimal point.

5. GROUPING OF DIGITS

a. Digits should be separated into groups ot three, counting from the decimal marker. The comma should not be used. Instead, a space is left to avoid confusion, since many countries use a comma for the decimal marker.

b. In numbers of four digits, the space is not recommended, unless four-digit numbers are grouped in a column with numbers of five digits or more.

6. SPACING

a. In symbols or names for units that have prefixes, no space is left between letters making up the symbol or the name.

b. When a symbol follows a number to which it refers, a space must be left between the number and the symbol (except for degree, minute, and second of angle).

7. COMPOUND UNITS

In the symbol for a compound unit that is formed by the multiplication of two or more units, a centered dot is used. For example, N•m.

In the name of such a unit, a space is recommended (or a hyphen is permissible) but never a centered dot. For example, newton meter or newton-meter.

APPENDIX 3

Quotation from the American National Standard for Metric Practice, Z210.1-1976

3.4.1.1 The principal departure of SI from the gravimetric system of metric engineering units is the use of explicitly distinct units for mass and force. In SI, the name kilogram is restricted to the unit of mass, and the kilogram-force (from which the suffix *force* was in practice often erroneously dropped) should not be used. In its place, the SI unit of force, the newton, is used. Likewise, the newton rather than the kilogram-force is used to form derived units which include force, for example, pressure or stress ($N/m^2 = Pa$), energy ($N{\cdot}m = J$), and power ($N{\cdot}m/s = W$).

3.4.1.2 Considerable confusion exists in the use of the term *weight* as a quantity to mean either *force* or *mass*. In commercial and everyday use, the term *weight* nearly always means *mass;* thus, when one speaks of a person's weight, the quantity referred to is mass. This nontechnical use of the term weight in everyday life will probably persist. In science and technology, the term *weight of a body* has usually meant the force that, if applied to the body, would give it an acceleration equal to the local acceleration of free fall. The adjective "local" in the phrase "local acceleration of free fall" has usually meant a location on the surface of the earth; in this context the "local acceleration of free fall" has the symbol g (commonly referred to as "acceleration of gravity") with observed values of g differing by over 0.5 percent at various points on the earth's surface. The use of *force of gravity* (mass times acceleration of gravity) instead of *weight* with this meaning is recommended. Because of the dual use of the term weight as a quantity, this term should be avoided in technical practice except under circumstances in which its meaning is completely clear. When the term is used, it is important to know whether mass or force is intended and to use SI units properly as described in 3.4.1.1, by using kilograms for mass or newtons for force. □

STAFF REPORTS

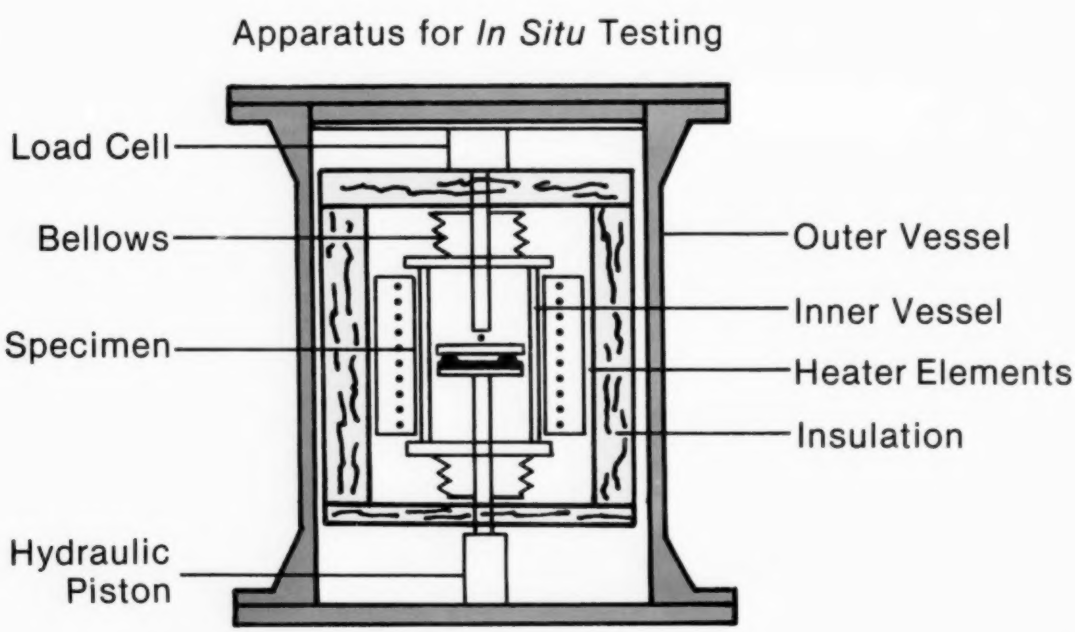
REFRACTORY CONCRETE STRENGTH MEASURED UNDER SIMULATED USAGE CONDITIONS

Mechanical properties that relate to the structural integrity of refractory concretes intended for use as liners in coal conversion systems can be influenced by both environment and temperature. Thus, it is important that data on these properties, such as strength, be gathered under simulated usage conditions. Researchers at NBS, under DOE sponsorship, have designed and built an apparatus that allows them to measure fracture strength of refractory concretes during exposure to reactive environments at elevated temperatures and pressures. Previously, these measurements were made by exposing the material to the test conditions in a chamber, and then removing the sample to room temperature and atmospheric pressure to conduct the tests. Initial experiments with this apparatus indicate that the strength of the concrete at these higher temperatures and pressures is approximately 2 to 3 times greater than its strength after exposure. This research should provide valuable information which the coal conversion industry can use in selecting concrete for various purposes.

Edwin R. Fuller, Sheldon M. Wiederhorn, and D. Ellis Roberts, Fracture and Deformation Division, A355 Materials Building, 301/921-2901, and Carl R. Robbins, Ceramics, Glass, and Solid State Science Division, A221 Materials Building, 301/921-2910.

The extreme temperature-pressure conditions and corrosive environments of coal gasification processes present major new problems for mechanical property measurements. An apparatus capable of performing these measurements at elevated temperatures and pressures and in the presence of various mixtures of gaseous environmental components has been designed and constructed by NBS scientists. The unit (see figure 1) consists of four essential parts: an externally heated inner environmental chamber to contain the corrosive gases; an external pressure vessel to maintain the structural integrity of the environmental chamber during elevated temperature-pressure operation; a pressure-balancing system to maintain a minimum pressure differential between the inner and outer chambers; and a load

Figure 1—*Schematic diagram of apparatus for mechanical property testing of refractory concretes in simulated coal gasification environments.*



application system to measure the fracture strength of refractory concretes at elevated pressure and temperature.

Satisfactory operation of the unit's various subsystems has been established. To verify the operation of the unit as a whole, initial experiments were conducted on both a low alumina (56 percent) and a high alumina (94 percent) refractory concrete in steam. A few minor problems were encountered; most of these difficulties have been corrected. The results of these initial experiments (table 1) are consistent with those from previous experiments in which the strength was determined after the elevated pressure-temperature exposure. This comparison, however, cannot be made directly, since the conditions of the present experiments do not duplicate exactly those of previous experiments.

Currently, measurements of elevated pressure-temperature strength following a 100-hour exposure in high pressure steam are being conducted *in situ* at temperatures of 360 °C, 600 °C, and 1010 °C on newly formulated batches of both a high alumina (94 percent) and a low alumina (56 percent) refractory concrete. To complement the *in situ* measurements, additional refractory specimens are exposed simultaneously to the elevated temperatures and pressures. These additional specimens are then removed and tested at room temperature and atmospheric pressure. Initial results on the high alumina refractory concrete indicate that the *in situ* strength of the concrete is approximately two to three times greater than its strength after exposure.

Table 1—*In situ strength of calcium-aluminate-bonded refractory concretes in elevated pressure-temperature steam*

Refractory Concrete	Exposure Condition	Median Strength	Mineral Phases*
Low-Alumina (56%)	Control (dried at 110 °C & fired at 1010 °C)	9.6 ± 2.1 MPa 1400 ± 300 psi	Mullite, cristobalite $CaO \cdot Al_2O_3$, α-alumina
	17 h at 400 °C & 2.07 MPa 100 h at 620 °C and 4.14 MPa	13.1 ± 1.5 MPa 1900 ± 200 psi	Mullite, cristobalite, anorthite, α-alumina,
High-Alumina (94%)	Control (dried at 110 °C & fired at 1010 °C)	14.8 MPa 2150 psi	α-alumina, $CaO \cdot Al_2O_3$
	110 h at 410 °C and 4.55 MPa	10.9 ± 0.3 MPa 1600 ± 50 psi	α-alumina, $CaO \cdot Al_2O_3$
	90 h at 510 °C and 4.86 MPa	11.2 ± 1.2 MPa 1600 ± 200 psi	α-alumina $CaO \cdot 2Al_2O_3$, $CaO \cdot 2Al_2O_3$,

* Mineral phases were determined at room temperature after the elevated pressure-temperature exposure and strength measurement.

CHEMICAL DEGRADATION OF REFRACTORY LINERS IN COAL GASIFIER SYSTEMS

In coal gasifier systems, reactive gas components and slag or ash interact with the protective refractory liner or the various components, frequently resulting in chemical degradation of the ceramic liner. NBS scientists are developing methods and equipment to obtain critical data on refractories, slags, and atmospheres under simulated gasification conditions. The effects of modifications and interactions at high temperatures and pressures on the durability and reliability of coal gasifier construction materials can then be evaluated.

Floyd A. Mauer, Ceramics, Glass, and Solid State Science Division, A221 Materials Building, 301/921-2910, William S. Brower, Ceramics, Glass, and Solid State Science Division, B214 Materials Building, 301/921-2842, and John W. Hastie, Chemical Stability and Corrosion Division, A329 Materials Building, 301/921-2859.

In a continuing study of chemical degradation, reactions of various refractory castable liner materials in steam and in simulated gasification atmospheres have been monitored *in situ* by energy dispersive x-ray diffraction. All specimens were of compositions within the system CaO-Al_2O_3-SiO_2. They included a high alumina castable (94.4 percent by weight alumina, 4.5 percent by weight lime) and a calcined flint clay castable (55.6 percent by weight alumina, 4.5 percent by weight lime, 37 percent by weight silica) as well as special compositions corresponding to known bonding phases.

New light was shed on factors affecting the development of strength in calcined flint clay castables by a series of experiments in which a test bar approximating the composition CAS_2* was heated in steam. An unfired test bar, compounded from CA-25 cement and silica in the form of quartz, was exposed to steam for a total

* *Term used in the Cement Industry for CaO-Al_2O_3-$2SiO_2$.*

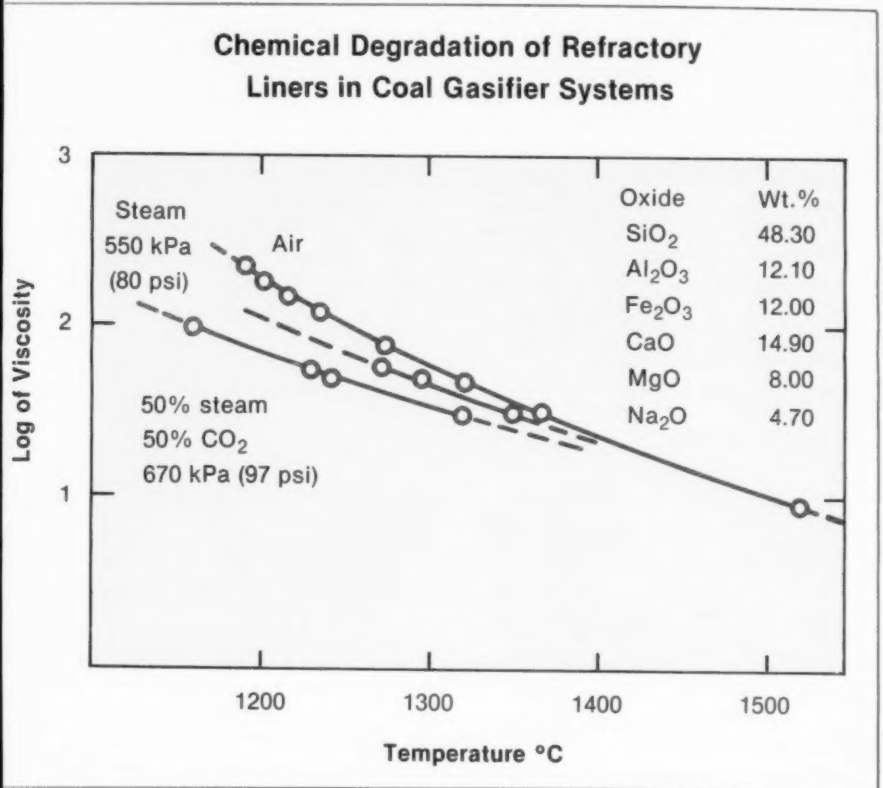


Figure 1—*Log viscosity (poises or tenths of Pa) versus temperature for a synthetic iron aluminum silicate slag in air at ambient pressure, in steam at 550 kPa (80 psi), and in 50 percent steam—50 percent CO_2 at 670 kPa (97 psi).*

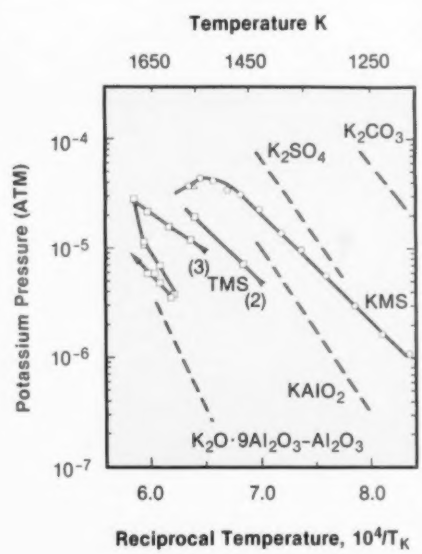


Figure 2—*Variation of potassium partial pressure with temperature for K_2O contents by weight of 19.1-17.8% (open circles, Knudson effusion Mass Spectrometric technique, KMS), 18.17-18.07% (run 2-open squares, TMS), and 18.07-18.0% (run 3-open squares, TMS) obtained from a coal slag of initial composition in % by weight of Al_2O_3 (12.06), CaO (3.8), Cr_2O_3 (1.3), Fe_2O_3 (14.25), K_2O (19.54), MgO (1.03), Na_2O (0.47), SO_3 (0.21), SiO_2 (46.82), and TiO_2 (0.52). Corresponding pressure curves (literature data) for the phases $K_2CO_3(l)$, $K_2SO_4(l)$, $KAlO_2(s)$, and $K_20 \cdot 9Al_2O_3$—$Al_2O_3(s)$ are given for comparison. The triangular point at 1515 K is a TMS data point corrected for the presence of O_2. Each curve represents a separate experimental run. Usually, data were obtained for successive increases in temperature except for run 3-TMS where the arrows indicate the run chronology, i.e., T increasing or decreasing.*

of 500 hours in two series of experiments. The rather surprising observation is that a metastable phase, $Ca_8Si_5O_{18}$, not previously encountered in these studies, was formed at approximately 160 °C in preference to hexagonal or triclinic CAS_2 (anorthite). This new phase persisted to 525 °C and then reacted with SiO_2 over a 100 °C range to form triclinic CAS_2. The formation of $Ca_8Si_5O_{18}$ suppressed the formation of the important CAS_2 bonding phase by tying up the available calcium. Its occurrence is expected to delay the development of strength in green bodies (unfired material) and is, therefore, believed to be undesirable.

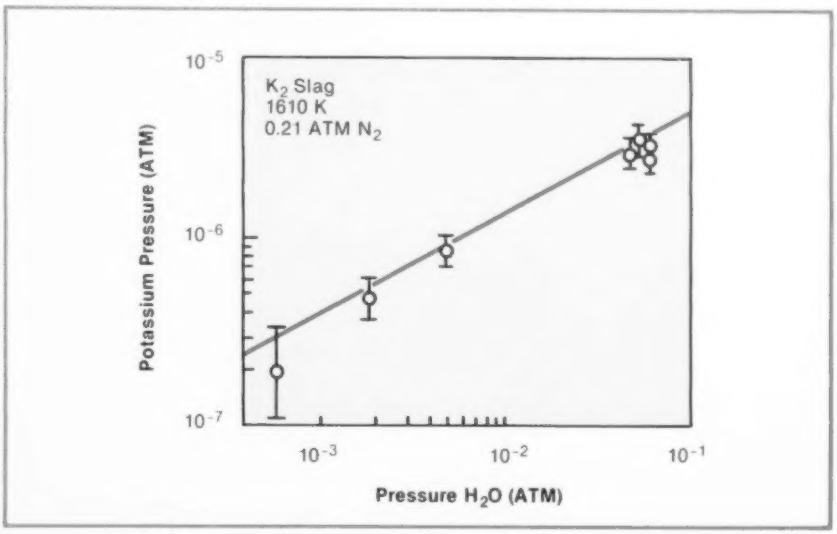
The viscosity of a synthetic coal slag in air, in steam at 80 psi (550 kPa), and in 50 percent steam-50 percent CO_2 mixture at 97 psi (670 kPa) was measured with a unique high pressure viscometer designed and built by NBS researchers. These atmospheres were selected to show the effect of a progressive decrease in oxygen pressure. The results are shown in figure 1. It appears that the viscosity of the iron-bearing slag decreases with decreasing oxygen pressure presumably because of an increase in the ratio of Fe^{2+} to FE^{3+} in the liquid. It also appears that the effect of the atmosphere on the viscosity decreases with increasing temperature possibly because of decreasing solubility of the gas in the molten slag. As a result, all the curves for a given slag appear to approach the same value at high temperatures.

Measurement of atmospheres under simulated gasification conditions were made with a Transpiration Mass Spectrometer (TMS) technique developed and refined by NBS scientists. The application and accuracy of the technique were shown using the NaCl and Na_2SO_4 test systems as well as a glass system. Alkali vapor transport was demonstrated on a quantitative basis for each of these systems over a wide temperature and pres-

sure range, up to 1700 K and 1 atm (100 kPa), respectively. A complete description of the TMS method and the results for NaCl and Na_2SO_4 was given at the Tenth Materials Research Symposium on Characterization of High Temperature Vapors and Gases, in September 1978.

More recently, the TMS method has been applied to highly complex heterogeneous systems including actual and synthetic coal slag mixtures in the presence of coal gas constituents such as H_2O, H_2, N_2, SO_2, and O_2. Molecular specific rates of vaporization have been measured as a function of temperature (up to 1700 K) as well as substrate and gas composition for total pressures up to 1 atm (100 kPa). For these data, mechanisms for vapor transport of alkali and other volatile slag components are being developed using multicomponent equilibrium *non-ideal* solution computer modeling.

Figure 3—*Dependence of pressure on H_2O—pressure at constant temperature, for a synthetic slag of initial composition in percent by weight of: SiO_2 (47.3), Al_2O_3 (11.1), Fe_2O_3 (12), CaO (13.9), MgO (7.8) and K_2O (8.7). The curve of slope 0.5 represents the theoretical pressure dependence for the reaction $K_2O(l)$ (in slag) + H_2 = 2K + H_2O where H_2 arises from the process $H_2O = H_2 + 1/2\ O_2$.*



To date, these experiments indicate the extreme sensitivity of alkali transport rate to temperature, pressure, composition, and the partial pressures of H_2O, O_2, H_2, and SO_2. Typical data showing the effects of temperature and composition are shown in figure 2. Figure 3 shows the effect of H_2O on the partial pressure of potassium over a synthetic modified "Western type" coal slag. Because of the widely varying nature of slag-coal gas reaction systems, it is clearly impractical to study experimentally each system of practical interest. Instead, more reliance will need to be given to computer modeling and its validation by carefully selected experimental studies.

DATA CENTERS ESTABLISHED TO AID COAL CONVERSION INDUSTRY

To assist members of the coal conversion industry, NBS, with the sponsorship of the Department of Energy (DOE), has established two information centers to collect, evaluate, and disseminate data on the performance and properties of materials used in plants converting coal to alternate energy forms. The Failure Information Center maintains a central source of information on the performance, especially the failures, of materials and components used in coal conversion environments to help industry members extend the useful life and reliability of these components. The Materials Properties Data Center will provide an integrated data base for construction materials to aid the industry in the design, construction, and operation of coal conversion plants.
Ronald C. Dobbyn, Fracture and Deformation Division, B120 Materials Building, 301/921-2952, and Helen Ondik, Ceramics, Glass, and Solid State Science Division, A221 Materials Building, 301/921-2900.

NBS has established a Failure Information Center which has a computerized data base of approximately 500 reported failures of materials and components used in coal conversion environments. Sources of this information include operators of all gasification and liquefaction processes ranging from bench-scale units to operating pilot plants who participate in the Department of Energy voluntary reporting program. Direct contact with operating personnel and failure analysis laboratory staff has enhanced both the quality and flow of information and assisted plant operators in problem solving.

Several reports of failure experiences have been drafted and information has been disseminated through the DOE's *Materials and Components Newsletter*, in which NBS and Battelle-Columbus cooperate. Presently, the Center produces sets of abstracts covering all reported incidences, sorted according to material, component type, failure mode, and conversion process, or any combination of these variables. Summary information in the form of statistical data is also available (see table 1).

During the past year, the Failure Information Center has completed a detailed study of the performance of materials used in the Conoco Lignite Gasification Pilot Plant (CO_2 Acceptor Process). This study is based on the information contained in the plant operating records and is not limited to reported failures. The report is now available from the Failure Information Center.

The second center, the Materials Prop-

erties Data Center, compiles data extracted from the research reports of DOE contractors who are studying construction materials which are candidates for use in coal conversion or MHD power generation plants. Currently, 30 projects are generating materials properties and performance data for coal conversion use and about a dozen groups are providing data for MHD power generation.

A detailed design of the structure of the materials properties data base has been planned. Storage of the data and access to it will be controlled through a commercially available data base management system. Contract proposals for computer vendors' services which will enable full implementation of the building of the data base are now under evaluation. Currently, the Center is prepared to answer mail and telephone queries of a limited nature.

The aim of the Center personnel is to provide a data base which will maximize the efficiency and versatility of handling the data, and therefore, maximize its usefulness. Simplicity of search patterns at minimum cost is a goal which greatly affects the utility of the data base for the user who will, in the future, be able to search directly via telephone line and his own computer terminal.

The two centers are joining efforts to produce a *Construction Materials Handbook for Coal Gasification* which will provide performance data on a wide variety of materials which have been used and/or tested for consideration as candidate construction materials. The first two sections of the book will deal with these data with respect to the various component areas of gasification plants. The third section will deal with commercially available materials judged to be reasonable candidates based on the data in the first two sections. Chemical, physical, and mechanical properties will be provided for the candidate alloys, refractories, and coated and surface-treated materials. A fourth section will deal similarly with promising materials which are still in an experimental or developmental stage.

For MHD materials, a state-of-the-art review is being prepared with the emphasis placed on, but not limited to, the information generated by the DOE research contractors.

Failure Mode Analysis
Coal Conversion Process

Failure Mode	Bigas	Battelle	CO_2	Cresap	Hygas	SRC	Synthane	Westinghouse	Other	Total
Corrosion	0	2	36	4	31	8	34	6	44	165
Aqueous	0	0	0	0	1	0	0	0	3	4
Carburization	0	0	8	0	1	0	0	1	2	12
Metal Dusting	0	0	4	0	0	0	0	0	3	7
Oxidation	0	0	2	0	4	0	0	1	4	11
Pitting	0	0	2	1	4	3	10	0	8	28
Sulfidation	0	0	13	0	12	0	6	1	4	36
General	0	2	7	3	9	5	18	3	20	67
Erosion	2	4	7	9	13	6	26	6	23	96
Equipment Malfunction*	5	4	6	3	11	2	9	2	6	48
Manufacturing Defect	8	10	11	9	7	8	28	5	19	105
Design	5	6	5	8	4	8	17	5	14	72
Fabrication	0	1	3	0	2	0	4	0	2	12
Quality Control	3	3	3	1	1	0	7	0	3	21
Stress Corrosion	2	0	5	1	7	6	6	8	16	51
Chloride	0	0	4	0	7	2	4	0	9	26
Other	2	0	1	1	0	4	2	8	7	25
Stress/Temp. Failure	0	2	1	0	6	0	6	6	9	30
Creep	0	0	0	0	1	0	0	0	3	4
Fatigue	0	2	0	0	2	0	3	4	4	15
Thermal Stress/Shock	0	0	1	0	3	0	3	2	2	11

* Failures From Temperature/Pressure Excursions.

Table 1—*Number of reported incidents of failures in coal conversion plants*

CONFERENCES

For general information on NBS conferences, contact JoAnn Lorden, NBS Public Information Division, Washington, D.C. 20234, 301/921-2721.

COMPUTER SYSTEMS INTEGRITY SYMPOSIUM

Papers by automatic data processing professionals, managers, and users are now being solicited for the 19th annual technical symposium of the Association for Computing Machinery (ACM) Washington, D.C., chapter and the National Bureau of Standards' Institute for Computer Sciences and Technology. The symposium will be held June 19, 1980, at NBS in Gaithersburg, Maryland.

With "Pathways to System Integrity" as its overall theme, the symposium will feature individual papers on topics including but not limited to:

—Security, privacy, authentication
—Data base
—Very large file technology
—Software error analysis
—Verification and validation
—Modern programming languages
—Performance metrics
—System architecture
—Information resources management
—Advanced techniques of requirements analysis and specification
—Design and implementation
—Human factors
—Application case studies
—Large-scale modeling and simulation
—Project management

Papers will be refereed, and those selected will be published in the proceedings. A special session will be devoted to summary papers on current research; only abstracts of this session's unrefereed papers will be published.

Four copies of candidate papers should be submitted by January 25, 1980, to James J. Pottmyer, 5540 North 32nd Street, Arlington, VA 22207. Notifications concerning acceptance of papers will be mailed by March 14. Final copy is due April 18.

For further information concerning the symposium's technical program, write to Angela Turvey, 4910 Butternut Drive, Rockville, MD 20853.

CONFERENCE CALENDAR

*January 15-17

COMPUTER SECURITY INITIATIVES, NBS, Gaithersburg, MD; sponsored by NBS and Department of Defense; contact: D. Branstad, A265 Technology Building, 301/921-3861.

*March 3-4

WORKSHOP ON COMPUTER INTERFACE STANDARDS, NBS, Gaithersburg, MD; sponsored by NBS; contact: W. E. Burr, B212 Technology Building, 301/921-3723.

*May 1-3

IMPLANT RETRIEVAL: MATERIAL AND BIOLOGICAL ANALYSIS, NBS, Gaithersburg, MD; sponsored by NBS, DOC, FDA, DHEW, VA and ASTM; contact: A. W. Ruff, B118 Materials Building, 301/921-2966.

May 5-7

TOPICAL CONFERENCE ON BASIC OPTICAL PROPERTIES OF MATERIALS, NBS, Gaithersburg, MD; sponsored by NBS in cooperation with OSA; contact: Albert Feldman, A251 Materials Building, 301/921-2840.

May 13-15

MEDILOG 80, NBS, Gaithersburg, MD; sponsored by NBS and DOD; contact: Charles Hulick, A740 Administration Building, 301/921-3465.

*June 2-6

6TH INTERNATIONAL CONFERENCE ON VACUUM ULTRAVIOLET RADIATION PHYSICS, UNIVERSITY OF VIRGINIA, CHARLOTTESVILLE, VA; sponsored by NBS, NRL, University of Virginia, NSF, DOE, IUPAP; contact: Robert Madden, A251 Physics Building, 301/921-2031.

*June 2-4

FIFTH INTERNATIONAL SYMPOSIUM ON ULTRASONIC IMAGING AND TISSUE CHARACTERIZATION, NBS, Gaithersburg, MD; contact: Melvin Linzer, A366 Materials Building, 301/921-2611.

*June 4-6

SECOND INTERNATIONAL SYMPOSIUM ON ULTRASONIC MATERIALS CHARACTERIZATION, NBS, Gaithersburg, MD; sponsored by NBS and ASNT; contact: Harold Berger, B312 Physics Building, 301/921-3331.

*June 19

19TH ANNUAL TECHNICAL SYMPOSIUM: PATHWAYS TO SYSTEM INTEGRITY, NBS, Gaithersburg, MD; sponsored by NBS, and ACM; contact: Carol Wilson, A252 Technology Building, 301/921-3861.

*June 22-27

NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, Shoreham-Americana, Washington, D.C.; sponsored by NBS and NCWM; contact: Harold Wollin, A211 Metrology Building, 301/921-3677.

** New Listings*

PUBLICATIONS

ADP RISK ANALYSIS GUIDELINES

*Guidelines for Automatic Data Processing Risk Analysis, Nat. Bur. Stand. (U.S.), Fed. Info. Process. Stand. Publ. (FIPS PUB) 65, 27 pages, for sale by the National Technical Information Service, Springfield, VA 22161, $4.50 paperback and $3.00 microfiche.**

A new guide issued by the National Bureau of Standards' Institute for Computer Sciences and Technology should help cut costly losses in data processing through the analysis of potential threats to computer systems and selection of appropriate protective measures. The guide describes step-by-step procedures that managers can adopt to assess risks and to select cost-effective safeguards for their computers and related assets.

Issued as Federal Information Processing Standard 65, the *Guidelines for Automatic Data Processing Risk Analysis* are designed to assist Federal agencies in developing and implementing computer security programs. Office of Management and Budget Circular A-71, Transmittal Memorandum No. 1 of July 27, 1978, requires that Federal agencies establish such programs and risk analysis as a basis for the selection of safeguards.

FIPS 65 details how to assess the damage and disruption of operations that might be caused by events such as natural disasters, fires, electrical outages, accidents, and penetration by intruders and how to estimate the expected frequency of these events. With these estimates, it is then possible to evaluate the cost of possible losses for each event and to make a cost effective selection of protective measures.

Managers of ADP installations outside the Federal Government should find the guidelines useful in conducting their own risk analyses for computer security. The guidelines include a practical example of how the risk analysis methodology can be applied.

EARTHQUAKE-RESISTANT BUILDING DESIGN ANALYZED

Harris, J. R., Fenves, S. J., and Wright, R. N., Analysis of Tentative Seismic Design Provisions for Buildings, Nat. Bur. Stand. (U.S.), Tech. Note 1100, 599 pages (July 1979) Stock No. 003-003-02084-2, $10.50.

To assist standards writers, code officials, and other specialists concerned with efforts to strengthen the earthquake resistance of buildings, the National Bureau of Standards has published a report that presents a detailed analysis of tentative seismic design provisions developed by the Applied Technology Council (ATC). The ATC is a private group associated with the Structural Engineers Association of California.

In order to facilitate effective use of the seismic design and construction concepts of the ATC-developed provisions, the publication, *Analysis of Tentative Seismic Design Provisions for Buildings*, provides:

- A listing of each of the more than 1200 discrete items of data or individual provisions developed by ATC, with a cross reference to the other data required for its evaluation and to the other provisions that use its value.
- A decision table for each of 340 provisions that displays the logic of the provisions without ambiguity and that has been tested to identify any gaps, redundancies, or contradictions in the logic.
- Information networks for each chapter and the document in its entirety, highlighting the flow of logic and assessing interdependency of provisions in a document that will be new to most users. The networks show that design paths exist with as many as 51 provisions in series sequence between input data and the final evaluation of compliance.
- A classification of the provisions according to the pertinent physical elements of the building processes, as well as the qualities required of these elements and processes. The classification is used to generate an index for locating provisions and alternative arrangements of the provisions to make them more accessible to various classes of users.

The 599-page analysis of the ATC provisions was written by James R. Harris and Richard N. Wright of the NBS Center for Building Technology and Professor Steven J. Fenves of Carnegie-Mellon University's civil engineering department. The authors cooperated with the ATC team during the original development of the tentative provisions, prepared under NBS contract by ATC. NBS and the National Science Foundation sponsored the project as part of the Cooperative Federal Program in Building Practices for Disaster Mitigation. The work by Harris, Fenves, and Wright is targeted for groups involved in further development and use of the provisions.

PROCEEDINGS OF 1978 EMI WORKSHOP

Arthur, M. G., Proceedings of the 1979 Electromagnetic Interference Workshop, Nat. Bur. Stand. (U.S.), Spec. Publ. 551, 57 pages (July 1979) Stock No. 003-003-02099-1, $2.50.

The National Bureau of Standards has published the Proceedings of a special two-day workshop on electromagnetic interference (EMI) held at its Gaithersburg, MD, headquarters in November 1978.

The workshop was held to assess the EMI situation and to explore solutions for this phenomenon, which has become a problem of national dimensions as more and more electronic products come on the market. The potential for sources of electromagnetic radiation to affect these

** Publications cited here may be purchased at the listed price from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (foreign: add 25%). Microfiche copies are available from the National Technical Information Service, Springfield, VA 22161. For complete periodic listings of all scientific papers and articles produced by NBS staff, write: Editor, Publications Newsletter, Administration Building, National Bureau of Standards, Washington, D.C. 20234.*

products is significant. In addition, the health consequences of long-term exposure to low levels of electromagnetic (nonionizing) radiation are unknown.

The Proceedings contain the text of five papers delivered at the Workshop covering the definition of major EMI problems, biological effects, Federal Communications Commission activities, pending Congressional legislation, voluntary standards and future technological challenges. Also included are the chairmen's summaries of five working groups on communications, transportation, consumer products, industry and medicine.

Researchers, regulators, consumer advocates and others with an interest in EMI problems will find the Proceedings informative and helpful.

Analytical Chemistry

Myklebust, R. L., Fiori, C. E., and Heinrich, K. F. J., Frame C: A Compact Procedure for Quantitative Energy-Dispersive Electron Probe X-ray Analysis, Nat. Bur. Stand. (U.S.), Tech. Note 1106, 111 pages (Sept. 1979) Stock No. 003-003-02113-0, $4.00.

Building Technology

Harris, J. R., Fenves, S. J., and Wright, R. N., Analysis of Tentative Seismic Design Provisions for Buildings, Nat. Bur. Stand. (U.S.), Tech. Note 1100, 599 pages (July 1979) Stock No. 003-003-02084-2, $10.50.

Galowin, L. S., and Debelius, J. R., Eds., Water Supply and Drainage in Buildings. Proceedings of an International Symposium, National Academy of Sciences, Washington, D.C., Sept. 28-30, 1976, Nat. Bur. Stand. (U.S.), Spec. Publ. 553, 232 pages (Aug. 1979) Stock No. 003-003-02101-6, $6.00.

Cooke, P. W., Ed., Research and Innovation in the Building Regulatory Process. Proceedings of the 3rd Annual NBS/NCSBCS Joint Conference held in Annapolis, MD, Sept. 12, 1978, in conjunction with the Eleventh Annual Meeting of the National Conference of States on Building Codes and Standards, Inc. (NCSBCS), Nat. Bur. Stand. (U.S.), Spec. Publ. 552, 358 pages (July 1979) Stock No. 003-003-02091-5, $7.50.

Computer Science and Technology

Berg, J., Chairman, Computer Science and Technology: Recommendations for Database Management System Standards, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-51, 99 pages (Aug. 1979) Stock No. 003-003-02095-8, $3.75.

Deutsch, D. R., Computer Science and Technology: Modeling and Measurement Techniques for Evaluation of Design Alternatives in the Implementation of Database Management Software, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-49, 244 pages (July 1979) Stock No. 003-003-02088-5, $5.50.

McEwen, H., Standard Industrial Classification (SIC) Codes, Nat. Bur. Stand. (U.S.), Fed. Info. Process. Stand. Publ (FIPS PUB) 66, 23 pages (Aug. 1979).

Weatherbee, J. E., Ed., Computer Science and Technology: Computer Performance Evaluation Users Group (CPEUG), Proceedings of the Fifteenth Meeting held at San Diego, CA, Oct. 15-18, 1979, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-52, 240 pages (Oct. 1979) Stock No. 003-003-02118-1, $5.50.

Westin, A. F., Computer Science and Technology: Computers, Personnel Administration, and Citizen Rights, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-50, 465 pages (July 1979) Stock No. 003-003-02087-7, $8.00.

Health and Safety

Howett, G. L., Some Psycho-Physical Tests of the Conspicuities of Emergency Vehicle Warning Lights, Nat. Bur. Stand. (U.S.), Spec. Publ. 480-36, 24 pages (July 1979) Stock No. 003-003-02085-1, $1.50.

Lewis, A. C., and Lewis, E., Jr., Guide to High Speed Patrol Car Tires, Nat. Bur. Stand. (U.S.), Spec Publ. 400-33, 42 pages (1979) Stock No. 003-003-02073-7, $2.00.

Electromagnetic Metrology

Arthur, M. G., Ed., Proceedings of the 1978 Electromagnetic Interference Workshop. Proceedings of a Workshop held at the National Bureau of Standards, Gaithersburg, MD, Nov. 2-3, 1978, Nat. Bur. Stand. (U.S.), Spec. Publ. 551, 57 pages (July 1979) Stock No. 003-003-02099-1, $2.50.

Electronic Technology

Harman, G. G., Nondestructive Tests Used to Insure the Integrity of Semiconductor Devices, with Emphasis on Acoustic Emission Techniques, Nat. Bur. Stand. (U.S.), Spec. Publ. 400-59, 72 pages (Sept. 1979) Stock No. 003-003-02116-4, $3.50.

Leedy, T. F., Large Scale Integration Digital Testing—Annotated Bibliography, 1969-1978, Nat. Bur. Stand. (U.S.), Tech. Note 1102, 44 pages (Aug. 1979) Stock No. 003-003-02097-4, $2.25.

Sawyer, D. E., and Schafft, H. A., Eds., Semiconductor Measurement Technology: NBS/DOE Workshop, Stability of (Thin Film) Solar Cells and Materials, Nat. Bur. Stand. (U.S.), Spec. Publ. 400-58, 181 pages (Aug. 1979) Stock No. 003-003-02100-8, $5.00.

Energy Conservation and Production

Burch, D. M., The Use of Aerial Infrared Thermography to Compare the Thermal Resistances of Roofs, Nat. Bur. Stand. (U.S.), Tech. Note 1107, 38 pages (Aug. 1979) Stock No. 003-003-02102-4, $2.00.

Environmental Studies: Pollution Measurement

Herron, J. T., Huie, R. E., and Hodgeson, J. A., Eds., Chemical Kinetic Data Needs for Modeling the Lower Troposphere. Proceedings of a Workshop held at Reston, VA, May 15-17, 1978, Nat. Bur. Stand. (U.S.), Spec. Publ. 557, 105 pages (Aug. 1979) Stock No. 003-003-02111-3, $4.00.

Fire Research

Ellingwood, B., and Shaver, J., Fire Effects on Reinforced Concrete Members, Nat. Bur. Stand. (U.S.), Tech. Note 985, 42 pages (Aug. 1979) Stock No. 003-003-02104-1, $2.00.

Instrumentation and Experimental Methods

Lederer, P. S., NBS Interagency Transducer Project 1951-1979—An Overview, Nat. Bur. Stand. (U.S.), Tech. Note 1110, 45 pages (Aug. 1979) Stock No. 003-003-02109-1, $2.25.

Lasers and Their Applications

Johnson, E. G., Jr., Design of a Reflection Apparatus for Laser Beam Profile Measurements, Nat. Bur. Stand. (U.S.), Tech. Note 1015, 124 pages (July 1979) Stock No. 003-003-02103-2, $4.00.

Nuclear Physics and Radiation Technology

Heaton, H. T., Jacobs, R., Proceedings of a Conference on Neutrons from Electron Medical Accelerators, Nat. Bur. Stand. (U.S.), Spec. Publ. 554, 172 pages (Sept. 1979) Stock No. 003-003-02115-6, $4.75.

Standard Reference Materials

Marinenko, R. B., Heinrich, K. F. J., and Ruegg, F. C., Micro-Homogeneity Studies of NBS Standard Reference Materials, NBS Research Materials, and Other Related Samples, Nat. Bur. Stand. (U.S.), Spec. Publ. 260-65, 84 pages (Sept. 1979) Stock No. 003-003-02114, $3.50.

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NEWS BRIEFS

MEASURING BLOOD ALCOHOL CONTENT. The NBS Law Enforcement Standards Laboratory has developed a standard for devices that police use to collect and store breath samples from people suspected of driving while under the influence of alcohol. The samples are subsequently analyzed in laboratories to determine blood alcohol content. Devices that meet the requirements of the standard--which is being proposed by the National Highway Traffic Safety Administration--will be able to store the samples for long periods of time without degradation.

SUPERCONDUCTING WIRE SAMPLE HOLDERS. An improper choice of materials for sample holders could affect critical current measurements of superconducting wires by as much as 30 percent according to Dr. Genshiro Fujii, a University of Tokyo guest worker at the NBS Boulder laboratories. He studied the effects of phenolic, copper, and fiberglass epoxy sample holders on current measurements. This represents an important potential error if the measurement data are used in the design of superconducting magnets.

ELECTRICAL FIRES IN TV'S. NBS has completed the first part of a study for the Consumer Product Safety Commission (CPSC) on electrical fire hazards in television receivers. In their tests, Bureau researchers simulated the short circuiting and failure of key electrical components in samples of both black-and-white and color TV's. Details are found in the report <u>Characteristics of Electrical Ignition Sources Within Television Receivers</u> (NBS TN 1109), Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Request SD Stock No. 003-003-02119-9, $2.50.

WEATHERIZATION OF LOW INCOME HOMES. More than 200 houses from 14 U S. cities have been weatherized with architectural and mechanical energy conserving options as part of an NBS research program conducted for the Community Services Administration. The project is the first extensive field check on the amount of heating energy used by houses in various climatic zones of the country and the savings that can be achieved through cost-effective energy conservation steps. It will also provide the building community with: 1) field installation procedures for architectural options, 2) infiltration rates on 300 homes before and after weatherization, 3) a simple field test for calculating energy conservation, and 4) accurate costs for the various options.

LEAP SECOND: AT THE LAST MINUTE. A leap second will be added to the last minute of 1979 in Coordinated Universal Time (UTC). NBS and other laboratories which use atomic clocks to keep standard time need leap seconds to make their clocks follow the variations in solar time. Since the U.S. lies west of the UTC Baseline near London, the leap second will occur here at one second before 7:00 p.m. EST, 6:00 p.m. CST, 5:00 p.m. MST, and 4:00 p.m. PST on December 31.

NEXT MONTH IN

DIMENSIONS NBS

Decisions affecting retail equity are moving beyond the marketplace. Read about how NBS' Standard Reference Materials are meeting these new measurement challenges in the next issue of DIMENSIONS.

U.S. DEPARTMENT OF COMMERCE

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Mark Helfer: Pages 6 and 10-12.
Cartoon: Sidney Harris, Page 9.

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